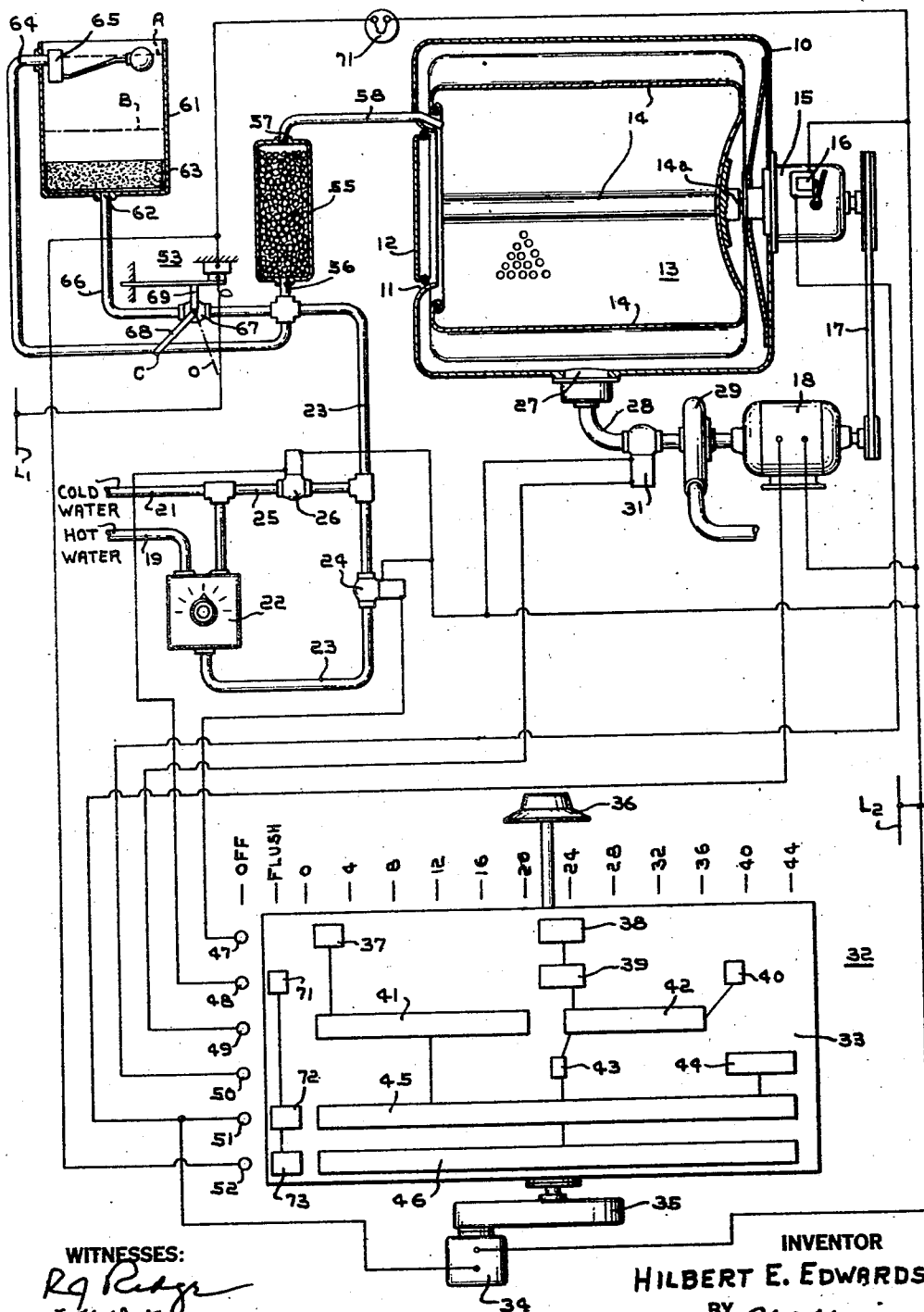


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H. E. EDWARDS
WASHING APPARATUS HAVING A WATER-SOFTENING
MECHANISM CONTROLLED THEREWITH
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WITNESSES:

R. H. Ridge
C. H. Lutz

INVENTOR
HILBERT E. EDWARDS.
BY *W. H. Steger*
ATTORNEY

UNITED STATES PATENT OFFICE

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WASHING APPARATUS HAVING A WATER-SOFTENING MECHANISM CONTROLLED THEREWITH

Hilbert E. Edwards, Mansfield, Ohio, assignor to
Westinghouse Electric Corporation, East Pitts-
burgh, Pa., a corporation of Pennsylvania

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11 Claims. (Cl. 68—12)

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My invention relates to washing apparatus for use in areas having relatively hard water, and has for an object to provide improved apparatus of this kind.

Further objects of the invention are to provide improved water-softening apparatus employing an agent requiring periodic regeneration, for use with a washing machine, and to regenerate the agent during periods when the washing machine is inactive.

A further object of the invention is to provide a simple inexpensive control mechanism for a washing machine and water-softening apparatus of the type set forth, which control prevents operation of the washing machine during periods when the softening agent is being regenerated and which is effective to flush the regenerating fluid from the conditioner prior to the initiation of the washing cycle.

A further object of the invention is to provide improved water-softening means for use with a washing machine of the automatic cycle type.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in accordance with the accompanying drawings, forming a part of this application, in which:

The single figure of the drawing is a diagrammatic view of an automatically-cycled washing machine having my improved water-softening mechanism applied thereto.

Reference will now be had to the drawings wherein I have elected to show my invention applied to a machine for washing and spinning clothes of the so-called horizontal axis type. This machine includes a tub 10 for containing a body of washing water and having an access opening 11 formed in the front thereof and closed by a suitable door 12. The tub 10 encloses a perforate basket 13 having a plurality of vanes 14 formed therein for agitating the fabrics in the washing water, as is well understood.

The basket 13 is carried by a shaft 14a which is rotated by means of a two-speed mechanism, generally shown at 15. The mechanism 15 is adjusted by means of an electro-magnet 16 which, when energized, effects high-speed operation of the basket 13 and, when deenergized, provides for low-speed operation of the basket 13. A suitable two-speed mechanism of the type shown at 15 is disclosed in my Patent No. 2,284,047, granted May 26, 1942, and assigned to the assignee of the present application. The two-speed mechanism is driven by a suitable pulley and belt arrangement 17 by means of an electric motor 18.

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Washing water is obtained from a suitable source defined by hot and cold water pipes 19 and 21, respectively, which are connected to an adjustable thermostatically-operated water-mixing device 22. The latter operates to mix the hot and cold water to provide water at a suitable temperature for the material to be washed. A suitable water-mixing device of the type shown at 22 is disclosed and claimed in the patent to Frank Breckenridge, No. 2,296,266, granted September 22, 1942, and assigned to the assignee of the present application. The device 22 discharges in a conduit 23 having an electrically-operated valve 24 connected therein. The valve 24 may be of any well-understood construction such as, a solenoid operated valve, and arranged so that the valve is open when energized and closed when deenergized. Preferably, a conduit 25 extends directly from the cold water conduit 21 to the discharge conduit 23, and flow of water through the conduit 25 is controlled by an electrically-operated valve 26 which functions in the same manner as the valve 24. When both valves 24 and 26 are open, the water passing through the conduit 23 will be at a lower temperature than that provided by the device 22. With this arrangement, relatively hot water may be used for washing, at which time only the valve 24 is open, and a lower temperature water employed for rinsing when the valves 24 and 26 are open. Furthermore, only cold water may be admitted to the conduit 23 when the valve 26 only is open.

Vitiated water is discharged from the tub 10 through an outlet opening 27 which is connected by means of a conduit 28 to the inlet of a pump 29, the latter being driven by the motor 18. Flow of water from the tub 10 to the pump 29 is controlled by an electrically-operated valve 31, which is so constructed and arranged that it is open when deenergized and closed when energized.

Energization of the various electrical translating devices referred to heretofore is controlled by a timer of the rotary drum switch type, generally shown at 32. The timer includes a cylindrical drum, shown in development at 33, and driven by a small electric motor 34 of the type generally employed for driving clocks. A reduction gear 35 is interposed between the motor and the drum 33, so that the latter is rotated at a relatively low speed of, for example, one revolution in approximately 48 minutes. The drum 33 may be manually rotated by a handle 36 independently of the motor 34, as is well understood.

The drum 33 includes a plurality of electrically-connected segments 37 to 46, inclusive, which co-

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operate with a plurality of stationary contact fingers 47 to 52, inclusive, for controlling energization of the valves 24, 26 and 31, the electro-magnet 16, and the motor 18 in order to sequentially operate these devices, whereby a washing, rinsing and spinning program is carried into effect. Further reference to this operation is made hereinafter.

A source of power for the various electrical translating devices is represented by the line conductors L₁ and L₂, the latter of which is directly connected to one side of each of the motor 18, the electro-magnet 16, and the solenoid valves 24, 26 and 31. The opposite terminals of the valves 24, 26 and 31 are electrically connected to the contact fingers 47, 48, and 49, respectively. The opposite terminals of the speed change mechanism 16 and the motor 18 are connected to the contact fingers 50 and 51, respectively. The contact finger 52 is connected through a line switch 53, to be referred to hereinafter, to the line conductor L₁. The timer mover 34 is connected in parallel with the main motor 18 so that it operates simultaneously therewith.

In accordance with my invention, an improved water-softening mechanism of the regenerative type is employed for softening the water admitted to the tub. My improved mechanism includes a container 55 for a water-softening agent, such as zeolite, which must be periodically regenerated after use in order to restore its water-softening properties. The container 55 has its inlet port 56 connected directly to the conduit 23 and includes an outlet port 57 connected by means of a conduit 58 to the interior of the tub 10. Accordingly, all water passed from the hot and cold water sources 19 and 21 through the conduit 23 is softened before it is admitted to the tub 10. The advantages of using soft water for washing purposes is so well known that it is deemed unnecessary to refer to these advantages herein.

As is well understood, after a certain period of use, the softening property of the agent in the container 55 is impaired so that the softening agent must be regenerated periodically to restore its water-softening properties. With zeolite or the like, regeneration is effected by subjecting the zeolite to salt carried in solution in water. The regenerating salt solution is preferably contained within an open-top vessel 61 having an outlet port 62 and a container 63 for water-soluble salts, such as, for example, common table salt. Water is admitted to the vessel 61 through a conduit 64 directly connected with the conduit 23 on the downstream side of the valves 24 and 26. The conduit 64 terminates in a conventional float valve 65, which operates to retain a predetermined amount of water or salt solution in the vessel 61. The discharge port 62 of the vessel 61 is connected by means of a conduit 66 to the inlet port 56 of the container 55, and flow of the solution through the conduit 66 is controlled by a transfer valve, such as, for example, a two-position cock 67. The latter is shown in its closed position, so that the salt solution in the vessel 61 is isolated from the conduit 23 and the container 55. When regeneration of the zeolite in the container 55 is to be effected, the cock 67 is moved to its open position, whereupon sufficient regenerating fluid is delivered from the vessel 61 to the container 55 to substantially fill the latter. Preferably, the vessel 61 is elevated with respect to the container 55 so that the delivery of salt solution to the latter is effected by gravity. The

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fresh water in the container which is displaced by the salt solution passes through the conduit 58 to the tub and drain. Further reference to this operation is made hereinafter.

The cock 67 includes an operating handle 68 having a cam portion 69 which is engageable with the line switch 53 and operates in such manner that the line switch 53 is closed when the cock 67 is in its closed position, and, conversely, the line switch 53 is open when the handle 68 of the cock 67 is moved to its open position. An indicating lamp 71 is connected between the line conductor L₂ and the load side of the line switch 53, so that it is illuminated at all times that the line switch 53 is closed.

When applied to an automatically-cycled domestic washing machine of the general type shown in the drawing, I prefer to use sufficient softening material to soften all of the water necessary for about four washing loads. Washing machines of this type are usually provided with an outer housing or casing, and I have found that a water conditioning mechanism of this capacity can be conveniently mounted within a standard casing. In the operation of this water conditioning mechanism, the base exchange material or softening agent contained within the container 55 is re-activated or regenerated during periods when the washer is idle. Preferably the vessel 61 holds sufficient salt for a month's operation so that it would only be necessary for the operator to add salt to the vessel 61 once during this period.

Operation of the washing machine is effected first by the closing of the cock 67, which isolates the salt solution in the vessel 61 from the container 55. This operation also closes the line switch 53 so that the washing machine may be operated. At this time, the container 55 contains a body of salt solution from a prior operation, so that it will be necessary to flush this solution from the container 55 before admitting washing water to the tub. Accordingly, the timer drum 33 is provided with three electrically-connected segments 71, 72, and 73, which are insulated from the segments 37 to 46 and which are engageable with the fingers 48, 51, and 52 in order to flush the container 55, as will now be described.

In initiating operation, the operator, after closing the cock 67, adjusts the timer drum 33 to the position marked "flush" on the drawing. This operation energizes the motors 18 and 34 and also the cold water valve 26, whereupon the motor 18 is operated and the opening of the valve 26 admits water from the cold water line to the container 55. The flow of water through the container 55 removes the salt solution therefrom, which solution is discharged into the tub 10. As the discharge valve 31 is open, the pump 29 is effective to discharge the salt solution to a suitable drain. The timer motor 34 operates for about two minutes, at the end of which time the segments 71, 72 and 73 are disconnected from their respective contact fingers, so that operation of the timer and the main motor 18 is terminated. Deenergization of the valve 26 terminates the flow of water through the container 55. During the flushing of the container 55, water is admitted to the vessel 61 through its float valve 65 in order to replenish the supply of fluid discharged during a prior operation. The apparatus is now ready for the washing operation.

The operator next deposits the fabrics to be cleaned and the necessary washing materials in the basket 13 through the access opening 11 and closes the door 12, after which the timer drum 33

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is moved manually a sufficient distance to engage the contacts 37, 41, 45, and 46 with their respective contact fingers. The engagement of the contact segment 37 and its finger 47 energizes the mixed water valve 24, so that water at the proper temperature is passed through the container 55 for softening and then discharged to the tub. As the contact segment 41 and the finger 49 are engaged, the drain valve 31 is energized and, therefore, closed.

The main motor 18 operates to rotate the basket at a relatively low speed for washing the fabrics, it being understood that, at this time, the speed change magnet 16 is deenergized. At the conclusion of about twenty minutes' operation, the drain valve 31 is opened by the disconnection of the segment 41 and its finger 49. Accordingly, the pump 29 discharges the vitiated washing water from the tub 10. After approximately one and one-half minutes' operation, during which period the water is discharged from the tub, the contact segments 38 and 39 engage their respective fingers 47 and 48, so that both the cold water valve 26 and the mixed water valve 24 are opened. Accordingly, rinse water at a temperature lower than the temperature employed for washing is passed through the conditioner 55, wherein it is softened and then discharged to the tub. The drain valve 31 is maintained open so that the water admitted at this time is a flushing rinse, which water is discharged as fast as it is admitted. A short period of centrifuging may be effected at this time by the engagement of the segment 43 and finger 50, which effects energization of the speed change magnet 16. Accordingly, a substantial quantity of the washing fluid is discharged from the fabrics.

After a short period of centrifuging, the drain valve 31 is again closed by the engagement of the segment 42 and finger 49. Rinse water continues to flow to the tub through the valves 24 and 26 until the segments 38 and 39 are disconnected from their respective fingers 47 and 48. The motor operates to rotate the drum at low speed for tumbling and rinsing the fabrics in the clear rinse water until the thirty-six minute period is reached, as shown in the timer diagram. At this time the drain valve 31 is again opened by the disconnection of the segment 42 and finger 49. The vitiated rinse water is now discharged from the tub and the final centrifuging of the fabrics is initiated by the engagement of the segment 44 and finger 50. At this time a final spray or flushing rinse may be effected for about two minutes, which operation is initiated by the engagement of the segment 40 and finger 48. As the drain valve is open, the water admitted at this time is discharged as fast as it is admitted. The flushing rinse water admitted at this time is only cold water, as the valve 24 is retained closed. Accordingly, the fabrics are cooled and a substantial part of the moisture in the air within the washer is condensed therefrom. The operation of the washing apparatus is terminated by the disengagement of the fingers 44, 45, and 46 from their respective segments 50, 51, and 52.

The apparatus is now in condition for a second washing operation, which may be initiated by adjusting the drum 33 through its flush position to the position wherein the washing operation is actually started. When the final washing operation has been completed, the apparatus is rendered inactive by moving the cock 67 to its open position, whereupon a quantity of salt solution passes from the vessel 61 to the container 55 and

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is sufficient to substantially fill the latter. At this time the level of the salt solution in the vessel 61 drops from the broken line A to the broken line B. The water remaining in the container 55 from the washing operation is forced upwardly into the tub 10 by the salt solution admitted at this time and drains off through the conduit 28, the drain valve 31, and the pump 29. The opening of the cock 67, of course, is accompanied by the opening of the line switch 53, which completely disconnects the timer and the other electrical translating devices from the line. Also, the opening of the line switch 53 deenergizes the lamp 17. A complete cycle of operation has now been described.

The vessel 61 may be of relatively light construction as it is not subjected to the full pressure of the water supply system at any time. Accordingly, the vessel 61 may be an open-top vessel or one provided with a light cover so that salt may be readily admitted to the vessel 61 by the operator without the necessity of breaking a pressure-tight joint.

Reference is made to my copending application, Serial No. 500,941, filed September 2, 1943, and assigned to the assignee of the present application wherein I have disclosed and claimed a regenerative type water-softening mechanism applied to a washing machine and having a container for a softening agent and a vessel for reactivating fluid elevated with respect to the container for the gravitation of fluid to the container.

From the foregoing description, it will be apparent that I have provided improved apparatus for washing fabrics or the like wherein softened water is employed at all times for the washing and rinsing of the fabrics. The arrangement is such that the softening agent is reactivated during the relatively long periods obtaining between washing operations and flushing of the softening agent is readily effected prior to the operation of the washing apparatus. My improved control apparatus prevents operation of the washer during reactivation of the softening material and vice versa. With the exception of the periodic addition of salt to the vessel containing the reactivating fluid, the apparatus needs no further attention of the operator. While I have shown my invention applied to a machine for washing fabrics, it will be understood that it may be applied to other forms of washing apparatus, such as, for example, apparatus for washing tableware or the like.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In washing apparatus, the combination of a tub for containing a body of washing water, a container for a water-softening agent, means for conveying softened water from the container to the tub, a valve controlling the flow of water through said container, control means associated with the washing apparatus and movable to respective stations for opening and closing said valve, a source of regenerating material for regenerating said water-softening agent, adjustable means manually movable to a first position for delivering regenerating material to said container and to a second position for isolating the

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regenerating material from the container, and means responsive to adjustment of the adjustable means to said first position for rendering said control means ineffective to open said valve regardless of the station to which the control means is adjusted.

2. In washing apparatus, the combination of a tub for containing a body of washing water, a container for a water-softening agent, means for conveying water through the agent in the container to the tub and including a valve, timing means for opening and closing said valve, a source of regenerating material for regenerating said agent, means connecting the source of regenerating material and the container and including a control valve manually movable to open and closed positions, and means responsive to movement of the control valve to its open position for rendering the timing means ineffective to open the first-mentioned valve.

3. In washing apparatus, the combination of a tub for washing water, a conduit for admitting washing water to the tub and having a valve connected therein, a drain valve for controlling the discharge of vitiated water from the tub, a timer for operating said valves in a predetermined sequence, a container for a water-softening agent connected in said conduit, a second container for material for regenerating the softening agent, adjustable means associated with said containers and manually movable to a first position wherein the regenerating material is admitted to the softening agent and to a second position for isolating the material from the agent, and means responsive to movement of the adjustable means to its first position for rendering the timer inactive and for closing the first-mentioned valve.

4. In washing apparatus including a tub for containing a body of washing water, means within the tub for washing the material to be cleaned, means for admitting water to the tub, means for discharging vitiated water from the tub, and a master control for sequentially operating said means whereby a predetermined washing program is automatically effected, the combination of a container for a water-softening agent associated with said water-admitting means for softening the water admitted to the tub, a vessel containing fluid for regenerating the softening agent, manually-operated means movable to one position for delivering regenerating fluid to the softening agent in said container and for rendering said master control inactive, said manually-operated means being movable to a second position for isolating the regenerating fluid from the softening agent and for conditioning the master control for operation, and means associated with the master control and effective when initiating operation of the washing apparatus for delivering water to the softening agent for a predetermined period of time whereby the regenerating fluid is flushed from the container.

5. In washing apparatus, the combination of a tub for containing washing water and the material to be treated, a conduit for conveying water to the tub and having an inlet valve connected therein, means for draining vitiated water from the tub, a timer for sequentially operating said inlet valve and said draining means, a container for a water-softening agent connected in said conduit, a vessel for containing fluid for regenerating said agent, valve means movable to a first position for conveying a quantity of regenerating fluid from said vessel to the container of the softening agent, said valve means being

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movable to a second position for isolating the agent in said container from the regenerating fluid in said vessel, control means responsive to movement of the valve means to said first position for rendering the timer inactive and for closing said inlet valve, said control means conditioning the timer for operation when adjusted to its second position, and means associated with said timer for opening said inlet valve and for actuating said draining means for a predetermined period of time prior to said sequential operation of the inlet valve and the draining means.

6. In apparatus for washing fabrics and the like, the combination of a tub for containing a body of washing water and the fabrics to be treated, means for washing the fabrics in said body of washing water, a container for a water softening agent, a vessel for containing water and a water soluble salt for regenerating said softening agent, manually-operated means for delivering a predetermined quantity of water and salt in solution from said vessel to the container, means for conveying water through said container to the tub, means for operating said water conveying means for a predetermined period of time at the initiation of operation of the washing apparatus for flushing the salt solution from the container to the tub and means for discharging the salt solution from the tub.

7. In apparatus for washing fabrics and the like, the combination of a tub for containing a body of washing water and the fabrics to be treated, means for washing the fabrics in said body of washing water, a container for a water softening agent having an inlet and outlet, means for conveying water from the outlet of the container to the tub, a vessel having an inlet and an outlet for containing water and a water soluble salt for regenerating said softening agent, conduit means for conveying water to the inlets of the vessel and container, an inlet valve controlling the flow of water to said conduit means, timing means for opening and closing said inlet valve, a float valve associated with said vessel for controlling flow of water through the inlet thereof in response to the level of the fluid in the vessel, means including a control valve connecting the outlet of said vessel and the inlet of said container, and means responsive to actuation of the control valve to its open position for closing said inlet valve independently of the timer, said last-mentioned means being effective, in response to actuation of the control valve to its closed position, to condition the inlet valve for operation under control of the timer.

8. In apparatus for washing fabrics or the like, the combination of a tub for containing a body of washing water and the fabrics to be treated, means for washing the fabrics in said body of washing water, a container for a water-softening agent, a vessel for fluid for regenerating said agent, means for supplying water through said container to the tub, means for draining fluid from the tub, a timer for operating the water supply means, the washing means and the draining means in a predetermined sequence, a control valve movable to a closed position for isolating the regenerating fluid in said vessel from the softening agent in the container, said control valve being movable to an open position for delivering a predetermined quantity of regenerating fluid to the agent in the container, means responsive to actuation of the control valve to its open position for rendering the timer inactive, said last-mentioned means being effective to con-

dition the timer for operation in response to actuation of the control valve to its closed position, and means associated with the timer for actuating the water supply means and said draining means for a predetermined period of time when initiating operation of the timer so that the regenerating fluid is flushed from the container and discharged from the tub prior to the admission of washing water to the tub.

9. In apparatus for washing fabrics or the like including a tub for containing a body of washing water, means for washing the fabrics in said body of water, and a conduit for admitting water to the tub and including an inlet valve, the combination of a container for a water softening agent of the type requiring periodic regeneration, said container being connected in said conduit, a vessel for containing fluid for regenerating the water-softening agent, said vessel being elevated with respect to said container so that the fluid may flow by gravity from the vessel to the container, a transfer valve controlling the flow of fluid from the vessel to the container, means for conveying make-up water to the vessel, means responsive to the amount of water in the vessel for controlling the flow of make-up water thereto, means for opening said transfer valve to regenerate the softening agent, means for opening said inlet valve for a predetermined period prior to initiating a washing operation for flushing the regenerating fluid from the container to the tub, and means for discharging the fluid from the tub.

10. In apparatus for washing fabrics or the like, the combination of a tub for containing a body of washing water, means for washing the fabrics in said body of water, means for admitting water to the tub and including a container for an agent for softening the water admitted to the tub, a vessel for containing a body of fluid for regenerating the water-softening agent, means actuated at will for delivering a predeter-

mined quantity of regenerating fluid to the container, means effective upon initiating operation of the washing apparatus for actuating the water-admitting means for a predetermined period of time sufficient to flush the regenerating fluid from the container to the tub, and means for discharging the fluid from the tub.

11. In washing apparatus, the combination of a tub for containing a body of washing water and the material to be washed, a container for a water-softening agent, a vessel for containing fluid for regenerating said agent, a source of water, time-controlled means for periodically delivering water from said source to the container and thence to the tub during the washing of said material, means manually actuated at will for delivering a predetermined quantity of regenerating fluid to the container, means associated with the time-controlled means for delivering a predetermined quantity of water from said source to the container when initiating a washing operation, said quantity of water being effective to flush the regenerating fluid from the container to the tub, and means for discharging the regenerating fluid from the tub.

HILBERT E. EDWARDS.

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